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INTRAVENOUS THERAPY GUIDELINES

Health Services Directorate

Health Services and Promotion Branch

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IMPORTANT

The information contained in these Guidelines was current at the time of publication. When using the Guidelines it should be remembered that certain aspects of medical technology are advancing rapidly. Should you identify any out-of-date material in the text, please inform:

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Further copies of these Guidelines can be obtained from the above address.

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INTRODUCTORY STATEMENT

One of the objectives of developing national guidelines is to prevent duplication of effort in hospitals across the country. Since evaluation of the care delivered to patients is a priority, and many hospitals are involved in developing quality assurance programs, guidelines for standards are developed at the national level.

Guidelines facilitate the setting of standards in hospitals, but respect the autonomy of each institution and recognize the governing body's authority and responsibility for ensuring quality of patient care.

Guidelines for the preparation and administration of intravenous fluids and admixtures are needed to assist hospital personnel in developing policies, procedures and evaluative mechanisms in order to ensure an optimal level of care.

The Health Services Directorate, Health Services and Promotion Branch, as one of its responsibilities, assists professional groups in the formation of guidelines. Series of guidelines have been produced by groups of experts, over several years, with the support of the Department of National Health and Welfare.

The Canadian Intravenous Nurses Association (C.I.N.A.) has, as one of its objectives, the promotion of higher standards of intravenous therapy for better and safer patient care. This objective is met by the provision of educational programs and the exchange of information pertaining to intravenous therapy. The need for Canadian guidelines in the field of intravenous therapy was met by C.I.N.A. through a request for assistance from the Department of National Health and Welfare.

The Canadian Society of Hospital Pharmacists (C.S.H.P.) also identified this need and had already established a committee to formulate guidelines.

The intravenous therapy guidelines herein were developed by a work group comprised of representatives of the three health care professions most involved in the administration of intravenous therapy: medicine, nursing and pharmacy. Representatives were named from the Canadian Medical Association, Canadian Hospital Association, C.I.N.A. and C.S.H.P. In order to facilitate the exchange of ideas and to prevent duplication of effort, the Chairman of the C.S.H.P. guidelines committee was named by the Society as a member of the group. The contribution of the C.S.H.P. committee, through its Chairman, proved to be instrumental in the rapid progress of the guidelines development. Coordination of the activities of the work group was the responsibility of the Health Services Directorate.

The guidelines have been based on research findings whenever possible, although there are some aspects of intravenous therapy about which there is insufficient published research to make firm recommendations. It is due primarily to this factor that the group has expressed a definite need to encourage research in this field and has recommended some areas of possible research activity.

To provide further assistance, sections on areas for hospital policy development, blood and blood components administration, and Total Parenteral Nutrition, as well as a glossary of terms used in intravenous therapy, have been included with the guidelines.

Both encouragement of research and frequent revision and updating to keep pace with advances in the field are necessary if these guidelines are to achieve the purpose for which they have been developed.

The work group acknowledges, with sincere appreciation, the many practising health professionals and others who contributed advice and information to this endeavour.

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I POLICIES AND PROCEDURES

A. HOSPITAL

1. All policies governing intravenous therapy, as well as procedures, must be in written form, be published in a hospital manual and be subject to periodic review. Specific reference should be made to the personnel qualified and authorized to carry out the policies and procedures.

2. The following areas should be covered by written policies and, where required, by written procedures:

   2.1 A multi-disciplinary committee authorized to monitor and review the practice of intravenous therapy.

   2.2 The departmental responsibilities.

   2.3 The education and training of personnel responsible for intravenous therapy.

   2.4 Infection control procedures that include such areas as storage, handling, preparation and administration of solutions and the care of the delivery system and site.

   2.5 An approved list of medications delineating the authorized personnel and circumstances for administration. Such a list, reviewed yearly and approved by the multi-disciplinary committee and the medical advisory committee, should include:

      a. I.V. drugs restricted to the physician only.

      b. I.V. drugs administered above the drip chamber by the registered nurse.

      c. I.V. drugs administered directly by the registered nurse in special care areas or registered nurses who have been specially trained and certified.

   2.6 The distribution systems for infusion control devices within the hospital, including responsible personnel for routine cleaning and performance testing.

3. Although controlled clinical studies are not yet available, it is likely that small teams of specially trained and highly motivated individuals, following specific protocols, can provide a consistently higher standard of aseptic care than can be achieved with a large heterogenous group of personnel who do not devote full time to this task.[1] Establishment of an intravenous nurse or team of nurses is advocated for hospitals of fifty beds and above.

3.1 Only specially trained nurses who maintain skills through continuous daily practice should perform venipuncture and related intravenous therapy procedures.

3.2 The person responsible for teaching the principles and practice of intravenous therapy should be required, on a regular basis, to demonstrate expertise in the specific skills involved.

B. PHARMACY

1. Receiving and Storage

1.1 Receiving and Inspection of Raw Materials

1.1.1 In pharmacy coordinated I.V. admixture programs, the pharmacist should be responsible for ensuring that all shipping cartons containing large and small volume parenterals, drug additives and related devices be inspected immediately when received by the hospital for signs of container damage and excessive abuse in handling.

1.1.2 Where admixtures are prepared by nursing personnel in the patient care unit, the pharmacist or other designated hospital personnel should be responsible for the storage and handling of commercial stock solutions prior to release to the patient care unit for use.

1.2 Handling of Defective Raw Materials

1.2.1 Damaged cartons should be separated from the rest of the shipment and the appropriate individual notified.

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1. Maki, D.G., Modern IV Practices, Medical Directions Inc., 1979, Chapter 4, page 47.

1.3 Storage of Raw Materials

1.3.1 Once unpacked, cartons and products must be properly stored and rotated, to comply with manufacturer's directions.

1.4 Inspection of Components Prior to Compounding

1.4.1 Prior to compounding, each component should be inspected to detect defects that were not apparent during receiving and storage. (i.e. damage due to mishandling, incomplete product, gross deterioration of products[2])

2. Compounding in the Hospital Pharmacy

2.1 General Consideration:

2.1.1 Where feasible, the hospital pharmacy should be responsible for a centralized intravenous admixture program.

2.2 Physician's Order

2.2.1 All I.V. admixture orders must be prescribed by the authorized physician on the patient's medication order form.

2.2.2 The order must be checked by the nurse for completeness prior to sending it to the pharmacy.

2.2.3 Stat or emergency orders may be taken over the phone from a physician or nurse by the pharmacist and then checked against the physician's original order.

2.3 Interpretation of Physician's Order

2.3.1 The pharmacist must interpret the order for clarity, appropriateness, completeness, dosage, stability and compatibility.

2.3.2 All problems relating to compatibility or stability arising from the prescribed order must be transmitted directly to the prescribing physician and to the nurse in charge.

2. "National Co-ordinating Committee on Large Volume Parenterals Recommended Methods for Compounding Intravenous Admixtures in Hospitals", American Journal of Hospital Pharmacy, March 1975, page 262-269.

2.3.3 A special order clarification form should be sent by the pharmacist to the nursing unit when an order has been clarified with the prescribing physician. Such a clarification form should include:

- Patient's name, nursing unit, date.
- Medication ordered.
- Reason(s) for delay or change.
- Name of physician making clarification.
- New order (medication, strength, dosage, route of administration).
- Pharmacist's signature.

2.4 Preparation of Worksheet/Master Formula

2.4.1 A worksheet, master formula, or call card must be made out by the pharmacist for each admixture prepared. This form should include:

- Patient's name.
- Nursing unit and room number.
- Solution, type, volume and additives.
- Preparation techniques, compatibilities, problems, etc.
- Identification number.
- Date of preparation.
- Signatures of compounding pharmacist and/or technician.

2.5 Proper Use of the Laminar Air Flow Hood (LAFH)

2.5.1 Ideally, the LAFH should run 24 hours a day. If a 24-hour service is not provided, the LAFH must run at least 30 minutes prior to use.

2.5.2 The working counter top and sides of the LAFH must be thoroughly cleansed with an appropriate disinfectant prior to and after each use.

2.5.3 Bottles and other containers must be cleansed prior to placing inside the LAFH to minimize microbial contamination and particulate matter.

2.5.4 Cartons of I.V. solutions must not be placed or opened inside the LAFH.

2.5.5 Objects must be placed in such a manner as to allow sufficient space between them for a good flow of filtered air.

2.5.6 Work must be arranged and performed to minimize turbulance and prevent clean filtered air from washing over contaminated articles and contaminating those which must remain clean.

2.5.7 Good aseptic technique must be used at all times when working inside the LAFH. Personnel should wear gowns, masks, gloves, and hair caps during extensive manipulation of products or complex compounding and must refrain from unnecessary conversation, movements or interruptions when working under the LAFH.

2.5.8 An ultraviolet light may be used inside the LAFH and the LAFH should be enclosed by a protective curtain when not in use.

2.6 Reconstitution and Storage of I.V. Additives

2.6.1 Reconstitution of all parenteral products prepared by pharmacy must be done inside a LAFH.

2.6.2 Hands must be thoroughly washed with a detergent disinfectant and, when manipulation of the product is done, personnel should gown, mask, glove and use a hair cap.

2.6.3 Sterile needles and syringes should be used for the reconstitution of each product.

2.6.4 Stability and storage requirements of the reconstitued product should conform to the specifications stated in the manufacturer's product monograph.

2.6.5 The reconstituted product must be checked prior to and after reconstitution for presence of contaminants, container defects and colour changes.

2.6.6 Labels of reconstituted additives in which partial contents are removed should be dated and, if necessary, the time of reconstitution noted on the label.

2.7 Compounding Technique

2.7.1 All components and materials required for the preparation of I.V. admixtures should be assembled prior to admixture preparation and handled according to the manufacturer's recommendations.

2.7.2 Integrity of the manufacturer's quality control should be maintained. However, where this is altered, precaution must be exercised in the compounding technique.

2.7.3 Strict asceptic technique is essential during the compounding process.

2.7.4 Hands must be thoroughly washed with a detergent disinfectant as often as necessary to minimize contamination. Rings and watches must be removed prior to hand washing.

2.7.5 Touch contamination should be avoided.

2.7.6 Needles and syringes should be assembled prior to opening ampules to lessen the time that medication is exposed to the environment.

2.7.7 All container entry surfaces must be thoroughly swabbed with a disinfectant prior to entry of the container.

2.7.8 Multidose vials should be supported on the working bench in an upright position with one hand and entry of the needle should be made at a 45° angle to avoid coring.

2.7.9 In the handling of antineoplastic drugs, the following measures should be taken to minimize unnecessary exposure:[3]

a. Centralized handling of antineoplastic drugs.

b. Use of a Bio-hazard Hood for preparation and reconstitution.

c. Use of gloves and masks.

d. Use of centralized disposal-designed waste containers followed by incineration.

3. Turco, S.J., "Cancer Chemotherapeutic Agents: Handling and Disposal", The Amercian Journal of I.V. Therapy and Clinical Nutrition, February 1981, page 6.

e. Periodic blood work for personnel involved in admixing.

f. Appropriate information that a potential problem may exist to personnel handling antineoplastics.

g. Special labelling of containers to ensure proper handling and disposal.

2.8 Labelling

2.8.1 A label must be affixed to each I.V. admixture container. Information must include:

- Patient's name, identification number of admixture.
- Additive, strength and amount.
- Nursing unit and room number.
- Primary solution and total volume.
- Expiry date.
- Storage conditions (where necessary).

2.9 Records

2.9.1 A worksheet or master formula should be kept with each I.V. order prepared.

2.9.2 A profile should be maintained for each patient receiving I.V. therapy.

2.9.3 Physician's I.V. orders must be kept and be easily accessible when needed.

2.9.4 A permanent quality control record should be maintained for all samples sent for sterility, pyrogen testing and chemical analysis. This should be routinely reviewed.

2.10 Storage

2.10.1 All prepared solutions should be stored in accordance with the manufacturer's recommendations.

2.10.2 No food products, urine, or blood specimens should be stored with the I.V. admixtures.

Quality Control

3.1 Each pharmacy department should have written policies and procedures for quality control which should be reviewed and evaluated on a regular basis. These should ensure the quality of the product in terms of sterility, apyrogenicity, clarity, freedom from particulate matter, and potency when feasible.

3.2 Equipment

3.2.1 Laminar Air Flow Hood (LAFH) units should be inspected and certified at regular intervals to ensure efficacy.

The following parameters should be tested according to the instruction manual for the LAFH every six months by the supplier of the LAFH or by a reputable testing firm.[4]

- Air Velocity.
- Air Flow Patterns.
- Filtration Testing (DOP Test).

3.2.2 The LAFH should be routinely monitored microbiologically (i.e. once a month) and the pre-filter(s) changed every one to three months as required.

3.2.3 If an ultraviolet light is not part of the original equipment, a portable ultraviolet light may be used. The LAFH should be enclosed by a protective curtain when it is not in use.

3.3 Personnel

It is the responsibility of the pharmacist to monitor and evaluate the aseptic technique used by the personnel who are compounding the I.V. admixture.

3.4 Product

3.4.1 Representative samples of admixtures prepared should be checked on a regular basis for sterility. If the need arises, the official U.S.P. pyrogen test should be performed. For practical purposes, the Limulus Amebocyte Lysate (LAL) pyrogen test may be used for in-process quality control.

3.4.2 A permanent quality control record should be kept for all samples sent for sterility and pyrogenicity testing. These records should be readily accessible and periodically reviewed.

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4. "National Co-ordinating Committee on Large Volume Parenterals Recommended Methods for Compounding Intravenous Admixtures in Hospitals", American Journal of Hospital Pharmacy, March 1975, page 262-269.

3.4.3 Compounded products should be examined for particulate matter and clarity over a projected beam of light against a black background for light coloured particles and a white background for dark coloured particles.

3.4.4 Glass containers should be examined for cracks and plastic containers squeezed to test for leaks. All containers should be checked to ensure that they are properly sealed prior to distribution.

3.4.5 Adequate controls should be included in the compounding process to assure the potency of the final product.

3.4.6 It is advisable to follow manufacturer's recommendations regarding reconstitution and storage of solutions.

3.4.7 The pharmacist must check the label on the finished product for patient identity, location, medication and amount added, type and volume of solutions, accuracy of expiration date and storage directions.

3.4.8 The pharmacist must also check the I.V. order against additives and amounts actually used by examination of empty vials, ampoules, used syringes and volume of I.V. solution used.

4. Distribution

4.1 The pharmacist is ultimately responsible during the distribution and transportation of I.V. admixtures to the nursing unit.

4.2 Supportive personnel involved in the transportation of I.V. medications must be made aware of the importance of maintaining the sterility of the product and should be warned about the following:

4.2.1 Containers must not be damaged in any way during delivery to the floor. Any damaged containers must be returned to the pharmacy.

5. Emergency Orders

5.1 In life threatening situations, intravenous medications and admixtures would be prepared and administered immediately as the patient's condition indicates. Each special care unit and nursing care unit is expected to have available a stock of intravenous medications for emergency use. This should be checked on a regular basis to ensure that the stock is complete and that the medications are not outdated.

5.2 Policies should be developed to include:

a. Advance notification of the order to pharmacy.

b. Duration of I.V. additive order.

c. Hours of pharmacy additive service.

d. Procedures after regular pharmacy hours.

e. A list of medications should be prepared by the pharmacy and kept updated. The list should designate individuals who may prepare and/or administer the drugs, i.e. pharmacist, nurse, physician. If the pharmacist "on-call" or physician is not available, in an emergency situation, personnel should be designated to prepare the additive according to the policy of the hospital.

5.3 For Stat (Emergency) Orders, policies should be developed for such occurrences:

a. During Regular Pharmacy Hours

(i) Orders are marked "stat" and are forwarded to the Pharmacy.

(ii) Verbal orders may be taken by phone and it is preferable that the verbal order be checked against the original order as soon as possible (preferably before the additive is released), when the written order is available and confirmed according to hospital policy.

(iii) The I.V. admixture must be prepared under laminar flow hood conditions and quality control carried out.

b. After Regular Pharmacy Hours

(i) It is desirable to have the pharmacist on-call to prepare stat (Emergency) I.V. admixtures.

(ii) An updated list of medications should designate individuals who may prepare and/or administer the drugs, i.e. pharmacist, nurse, physician.

(iii) If the pharmacist on-call or physician is not available in an emergency situation, personnel should be designated to prepare the additive or admixture according to the policy of the hospital.

c. Alternate System

(i) Alternatively, it may be more feasible for the pharmacy department to limit the I.V. additive program to unusual or dangerous drugs or drugs which require a large volume dilution.

(ii) All drugs which can be added to a small volume parenteral can be added by the nurse at the nursing station.

(iii) A list of unusual or dangerous drugs or drugs which require a large volume dilution should be prepared by the pharmacy and kept updated. This list should designate individuals who may prepare and/or administer the drug, i.e. pharmacist, nurse, physician.

(iv) If a pharmacist or physician is not available in an emergency situation, personnel should be designated to prepare the additive according to the policy of the hospital.

C. PATIENT CARE AREA

1. Storage

1.1 Solution containers must be packaged properly on the appropriate clean carts, with glass containers in an upright position, prior to delivery to the nursing unit. Objects that are contaminated must not be placed on the clean carts.

1.2 Solutions delivered to the nursing unit must be checked by the nurse for any defects and then stored appropriately as stated on the label.

1.3 Food, blood or urine specimens must not be stored with the I.V. admixtures. There is a risk of microbial contamination.

2. Admixing

2.1. General Considerations:

2.1.1 Admixing in the patient care area should be assigned to a pharmacist, physician or a registered nurse.

2.1.2 The work area should be a designated clean area. Thorough daily cleaning is essential. Counter tops should be scrubbed with a suitable disinfectant prior to any admixing. Good lighting must be provided. Patient specimens and contaminated articles of any kind should be kept away from the admixing area.

2.1.3 Handwashing facilities should be available in the work area.

2.1.4 Personnel with upper respiratory symptoms or open cuts or sores on hands should not be involved in admixing.

2.1.5 During compounding, traffic flow must be kept at a minimum and personnel should not be interrupted. Windows should be closed. A separate room for compounding purposes is desirable, in the nursing unit if feasible.

2.1.6 Personnel must be trained to inspect both the large volume parenteral, the medication and supplies for signs

that sterility has not been maintained (i.e. cracks in glass containers, punctures in plastic containers, expiry dates on each container, presence of particulate matter or bacterial growth, etc.).

2.1.7 It is recommended that the needle gauge for reconstituting, withdrawing from the container and diluting prior to administration be not larger than 21 gauge. The smallest bore needle appropriate to the viscosity of the fluid should be used. The ideal practice would be the use of filtered needles.

2.1.8 When the plunger of a syringe is touched during withdrawal, it must be discarded following injection into a vial or container.

2.1.9 After withdrawing medication from the container, the needle must be changed to a smaller gauge needle prior to injecting the medication into the I.V. container. Coloured additives should be added last.

2.1.10 Information such as route of administration, dosage, mode of action, side effects, adverse effects and compatibility must be available. Information regarding reconstitution, admixing, and required infusion time is usually available from the manufacturer, appropriate reference or drug information centre.

2.1.11 Prior to admixing, the physician's order must be interpreted. The order may be transcribed on a medication sheet, a medication kardex or personnel may refer directly to the doctor's order sheet. The method of transcribing must assure prevention of medication errors.

2.1.12 Personnel handling antineoplastic drugs should:

a. Exercise precautions to minimize unnecessary exposure in preparation and administration. (see page 6, 2.7.9)

b. Employ measures to reduce side effects where possible, such as application of a head cuff or ice cap to the head to prevent hair loss and adequate use of antiemetics.

c. Employ extension sets when administering drugs which should not be administered simultaneously or mixed due to incompatability.

3. Reconstitution of Additives

3.1 Medications supplied in powdered form must be reconstituted prior to administration. The manufacturer's recommendation regarding type and amount of diluent required and final concentration should be followed. Reconstituted medication should be stored according to directions from the manufacturer. The expiry date and storage instructions must be affixed to the multi dose vial.

3.2 The medication and diluent should be inspected for particulate matter and expiry date.

3.3 Air must not be injected into the vial.

4. Labelling

4.1 A medication label for each medication added must be prepared at the time of admixture and affixed to the container to which the medication has been added. The label must contain the following information:

a. Patient's name.

b. Unique identifying number for that patient.

c. Patient's room number.

d. Additive, strength and amount.

e. Identification of primary solutions.

f. Time solution prepared and expiration date.

g. A number to identify the container (i.e. prescription or a consecutive numbering of containers) for a twenty-four hour period.

h. Administration directions including rate/hour or minute.

i. Ancillary precaution labels.

j. Identification of person preparing and hanging admixture.

5. Addition of Additives

5.1 Intravenous medications may be administered by continuous infusion, intermittent infusion, or I.V. push.

5.2 The hospital must have clearly stated policies concerning:

a. The medications which may be given by each method.

b. The personnel who may administer each I.V. medication.

c. The number of medications which may be added to a large volume parenteral.

d. The addition of additives during infusion to:

- primary containers
- secondary containers

6. Administration

6.1 General Considerations:

6.1.1 The nurse on the unit who prepares and adds medications to the infusion fluid is responsible for patient identification and administration.

6.1.2 During transportation from the clean work area to the bedside, the entry port of the glass container must be aseptically covered.

6.1.3 The patient must wear an identity band which must be checked. The nurse must also check for allergies indicated on an allergy band, kardex, etc.

6.1.4 When an I.V. is already in situ, the complete system for the correct solution, the appropriate administration set, competency of all connections and absence of air in the administration set must be checked. The cannula site must be free from signs of infiltration, phlebitis, palpable thrombitis, infection and symptoms of patient discomfort.

6.2 Initiation of a Peripheral I.V.

6.2.1 Physician's Order

a) The order must be written and must specify the date and time.

b) The order, or the transcribed order, must be available for identification of the patient, infusion solution and additive(s) at the bedside.

6.2.2 Selection of Appropriate Equipment

a) Plastic Container

(i) Provides a closed system containing an overfill of solution for priming and flushing and sterile air to accommodate accurate reading.

(ii) The outer wrap should remain intact and not be removed until the container is to be used.

(iii) The appropriate volume for the required rate of infusion should be chosen.

(iv) The correct solution, expiry date and any leakage should be noted and the container held to the light to check for particulate matter or bacterial growth.

(v) Use of a non vented administration set is required.

b) Glass Container

(i) The appropriate volume for the required rate of infusion should be chosen.

(ii) The correct solution, expiry date and any leakage or cracks should be noted and the container held to the light to check for particulate matter or bacterial growth.

(iii) Depending on the manufacturer, use of a vented or non vented administrtion set is required.

c) Containers should be numbered in sequence when different solutions are administered in 24 hours.

d) Administration Set

(i) Requirements for administration will determine the number of connectors and injection sites.

(ii) The delivery of drops per millilitre varies with each type of set and must be considered for accurate flow rate. Reference should be made to the manufacturer's package.

(iii) Volume control sets or mechanical devices are required to deliver a high degree of accuracy in volume or rate.

e) Site Preparation

(i) Two approaches may be used:

- Alcohol and an iodine containing disinfectant.
- Tincture of iodine 1% to 2% followed by 70% alcohol.

f) Dressing

(i) Two types of dressing may be used:

- Transparent occlusive dressing.
- Sterile dry dressing.

6.2.3 The patient should be identified by reference from the armband to the chart, kardex or I.V. ticket.

6.2.4 The allergy armband, when present, should be checked for allergies to drugs, skin preparation and tape.

6.2.5 The procedure and care of the equipment should be explained to the patient.

6.2.6 Hands should be thoroughly washed prior to assembly of the equipment.

6.2.7 Checking and Assembling Equipment

a) Plastic Container

(i) The container should be suspended on the I.V. pole before the insertion of the administration set.

b) Glass container

(i) The administration set should be inserted with the container in an upright position.

c) Administration Set

(i) All clamps must be closed before removing the protector.

(ii) The spike must be inserted into the container with a direct thrust and not a twisting motion, to avoid coring.

(iii) The drip chamber should be filled 2/3 full and be maintained at this level.

(iv) The piggy-back system should be avoided if possible. However, if the system is used:

- The site should be cleansed well with a disinfectant.
- A non siliconized needle should be used to help prevent pistoning.
- Frequent punctures should be avoided.

(v) The set should be flushed and injection sites cleared of air immediately before it is connected to the cannula.

6.2.8 Tourniquets should be cleaned or sterilized between patients.

6.2.9 Selection of a vein should include:

a) Consideration of the comfort of the patient.

b) Palpation of the vein to determine depth, size, length and softness.

c) Avoidance of

- Lower extremities.
- Below an existing phlebitis.
- Area over a joint.
- Inner aspect of wrist.

6.2.10 Selection of an appropriate cannula and gauge should depend on:

- Vein size, depth, length and position.
- Procedure or product prescribed.
- Rate and duration of therapy.

6.2.11 Hands should be thoroughly washed prior to preparation of the area.

6.2.12 Preparation of the area should include:

a) Cleansing the area from the site to the periphery.

b) Preparing an area equal to or larger than the dressing.

c) Repreparation before the dressing is applied if the area is touched during the insertion of the cannula.

6.2.13 Insertion of the cannula must ensure that:

a) The smallest gauge that will deliver the required rate is used.

b) The hub or connection is not touched.

c) The stylet is not pulled back to check for backflow.

d) Only two attempts at insertion should be made by one person.

e) A sterile cannula is used for each attempt.

6.2.14 Dressing application should consider the following:

a) Transparent occlusive or sterile dry dressings, enclosed by tape, should be used.

b) Date of site change should be indicated.

c) Tape should not be prepared and placed on the nurse's uniform or furniture, ready for use.

d) Securing the cannula firmly may reduce the incidence of mechanical phlebitis.

e) Tape should not be applied so that it encircles the arm completely.

f) Armboards should be disposable and used for one patient only. Reusable armboards must be washed and recovered between patients.

6.2.15 The flow rate should be regulated with the clamp directly under the drip chamber.

6.2.16 The date, time, solution, additive(s), gauge and position of the cannula and signature should be recorded on the patient's I.V. record.

6.3 Management of a Peripheral I.V.

6.3.1 General Considerations:

a) During I.V. therapy the complete system, including the cannula site, must be observed every hour. For this reason a transparent dressing should be used. If the cannula site is ignored, hazardous complications may go unnoticed or blood loss could result from pulled out cathethers or disconnected equipment.

b) Manipulation of the system should include:
   (i) Ensuring patient identification.
   (ii) Hand washing and the use of aseptic technique.
   (iii) Avoiding touch contamination.
   (iv) Closing all clamps during the removal of the empty container and spiking of a new container.
   (v) Readjusting the flow rate.
   (vi) Recording on the I.V. record.

c) Reading of a plastic container should involve:
   (i) Milking the sterile air down the container to the level of the solution.
   (ii) Pulling the sides taut and releasing.
   (iii) Reading at eye level with hands off.

d) Hospital policies must state if medicaton may be added to a container during infusion and should consider:
   (i) The possibility of inadequate mixing.
   (ii) The incorrect dilution of the ordered drug and the ordered volume of solution.

e) Containers, sets or sites may be labelled to ensure a routine change of equipment.

f) Clotted cannulas should not be irrigated or aspirated.

g) Disconnected equipment should not be reconnected.

h) Removal of cannula should include:

(i) Milking the vein toward the site after removing the cannula.

(ii) Taking a culture of the site and the intravascular portion of the cannula if purulent exudate is expelled or infection suspected.

(iii) Applying a sterile dry dressing.

i) Observations, manipulations and complications must be recorded on a permanent patient I.V. record. The required information should include:

(i) Date, time, solution, additive(s), dosage, amount absorbed and signature.

(ii) Date, time, gauge, and position of cannula placement and signature.

(iii) Remark column to indicate comfort, complications, description and signature.

6.4 Equipment Change

6.4.1 General Considerations:

a) When effective infection control policies are established and ongoing studies indicate a low rate of infusion related sepsis, then consideraton may be given to changing sets and cannula every 48 to 72 hours at the same time as a new container is hung.

b) Containers should be replaced whenever the cannula is changed and should hang no longer than 24 hours. If a "keep vein open" infusion is ordered, 250 mL containers of fluid are recommended.[5]

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5. Maki, D.G., Modern I.V. Practices, Medical Directions Inc., 1979, Chapter 4, page 44.

c) Administration sets should be replaced when the cannula is changed and routinely at intervals of 48-72 hours.[6,7]

d) A sterile dry dressing should be changed every 24 hours and the site observed closely for complications.[8]

(i) The site should be cleaned from the site to the periphery with one of the following:

- Alcohol and an iodine containing disinfectant.
- Tincture of iodine 1% to 2% followed by 70% alcohol.

(ii) An application of a topical antimicrobiol ointment may provide adjunctive benefit.

e) A transparent dressing, which allows visibility while remaining occlusive, requires changing only when the cannula site is changed.

7. Hazards and Complications

7.1 Phlebitis

7.1.1 Pain, redness, warmth, tenderness and palpable thrombosis, a common result of I.V. therapy, can be caused by:

a. Contaminated equipment or sites.

b. Duration of cannula in situ.

c. Cannula composition.

d. Difficult insertion.

e. Chemical irritation such as irritating drugs.

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6. Maki, D.G., Modern I.V. Practices, Medical Directions Inc., 1979, Chapter 4, page 28.

7. McGowan, J.E., Jr., "How Often Should Administration Tubing be Changed in I.V. Therapy?" The American Journal of Intravenous Therapy and Clinical Nutrition, December/January 1980, Page 19-22

8. Maki, D.G., Modern I.V. Practices, Medical Directions Inc., 1979 Chapter 4, Page 41 and 42, No. 8.

f. Mechanical irritation such as the gauge of cannula being too large for the vein or poor positioning or taping of the cannula.

g. Personnel with inadequate inservice education and/or experience.

7.1.2 Phlebitis Prevention Protocol

a. Early detection and accurate assessment are the best means of prevention and should include:

- Hourly observation of the site. A transparent dressing allows observation without manipulation and encourages more frequent site checks.
- Strict aseptic technique during insertion, manipulation and management.
- Strict policies for equipment change.
- Consideration of the use of a .22 micronfilter.
- Accurate assessment of the severity of the phlebitis must be recorded and reported to the physician.
- Yearly inservice teaching to staff members.
- Indepth knowledge of technique and equipment.
- Expertise in the practice of I.V. therapy.

b. A baseline study should be undertaken in all institutions to determine the efficacy of present technique and management of I.V. therapy. Without such information it is difficult to assess a problem or if there is indeed an increase in the incidence of phlebitis.

7.2 Infection

7.2.1 General Considerations:

a. Policies and procedures concerning infection control in the administration of intravenous therapy should be included in the overall infection control program of the institution.

b. Each hospital should have a multidisciplinary infection control committee with representatives from medicine, nursing, administration, pharmacy, microbiology and other important hospital support services.

c. Each hospital should have an infection control practitioner who is accountable to the infection control committee on surveillance, investigation, follow up, and statistical information.

d. Each hospital should have written policies and procedures pertaining to infection control in intravenous therapy which include the following:

- Procedures for initiating and maintaining intravenous therapy which minimize the risk of nosocomial infection.
- Policies which state the time limits of use of components of the infusion system.
- Procedures to be followed in suspected infusion-related infection and/or sepsis. (e.g., culture of the site and cannula, blood cultures).
- Procedures to be followed in reporting cases of suspected infusion-related sepsis.

e. In order to prevent the occurrence of infection, each institution should have:

- Written policies and procedures for intravenous therapy.
- Written standards for intravenous therapy practice.
- An orientation program and continuing in-service education for all staff whose duties include any aspect of intravenous therapy.
- Specifically trained personnel.

7.2.2 Infection Prevention Protocol

a. Aseptic technique or no touch technique. Most important are:
   - Washing of hands.
   - Good skin preparation.

b. Sterile and clean equipment
   - Checking of all equipment before use.
   - Avoiding touch contamination of sterile equipment.
   - Using tourniquets once for each patient and cleaning or sterilizing afterwards.

c. Change of Cannula site every 48-72 hours
   - Documenting date and time of site change.
   - Secure taping of the cannula.

d. Change of administration set every 48-72 hours
   - Writing date, time and signature on tape or label fastened to the administration set.
   - Changing the set whenever the site is changed.

e. Container change every 24 hours
   - Using small containers as bacteria grows quickly in warm solution. This is important for paediatric patients with small volume infusions.
   - Labelling of the container with the date and time.

f. Frequent check of Intravenous site
   - Daily by intravenous team nurse.
   - Every hour by floor nurse.

g. An intravenous team which follows an established protocol.

7.3 Medication Errors

7.3.1 As in the administration of any medication, the potential for error in the administration of intravenous medications

is a concern. Policies, procedures and practices should be developed to minimize the risk of error.

7.3.2 The physician's order should be checked by the nurse for clarity and completeness before it is sent to the pharmacy.

7.3.3 Each hospital should have a list of approved abbreviations.

7.3.4 A clear policy regarding telephone orders must be established.

7.3.5 The medication dispensed by the pharmacy should be checked when it is received in the nursing unit.

7.3.6 The admixture, prepared in pharmacy or in the nursing unit, must be verified with the physician's order before administration.

7.3.7 The patient's identity must be confirmed by means of the identification band. If the band is missing for any reason, it must be replaced, taking appropriate precautions to ensure that the information is correct. Allergy bands must also be checked.

7.3.8 To ensure patient safety, the pharmacist should review all intravenous medication orders of a non-emergency nature, before such medications are administered. Bypassing the pharmacy increases the hazard of error and/or drug incompatibilities.

7.3.9 In the case of stat medications, the nurse is responsible for knowing the action, potential side effects and appropriate dosage of the medication administered.

7.3.10 Intravenous medications should be charted immediately after administration to avoid the possibility of a repeat dose being given in error.

7.3.11 Medication errors must be immediately reported to the physician, nurse in charge and the pharmacist and recorded.

7.4 Mathematical Error

7.4.1 The amount of a drug ordered should be checked by both the pharmacist and nurse to ensure that it is within the normal range for that drug, and clarification is required if it is outside that range.

7.4.2 Paediatric units have a responsibility to ensure appropriate reference material since many standard references list only usual adult doses.

7.4.3 To minimize this risk for errors, it is advisable to have a second person verify the dosage. To reduce mathematical errors, premixed solutions should be used whenever available.

7.4.4 Mathematical calculations for the drip rate should be in accordance with the type of administration set to be used.

8. Complementary Devices

8.1 Heparin Locks

8.1.1 General Considerations

a. These devices allow the patient freedom and comfort during intermittant therapy. They may be used for:

(i) Daily injections, infusion or transfusion.

(ii) Maintaining an emergency route.

(iii) Procuring intermittent venous blood specimens.

b. Heparin Locks should be flushed with a quantity of heparin sodium which does not alter normal coagulation, every 8 hours. This device should be removed every 48 hours.

c. The technique, observations and care are the same as for an I.V. site.

d. A physician's order is required for insertion.

8.2 Filters

8.2.1 General Considerations:

a. In the clinical setting, controlled admixture preparations and the use of filters have reduced particulation.[9] Although the precise biological effects of particulates injected into humans is still undefined, their undesirability should be clear, especially when means are readily available of preventing them from entering man's internal environment.

b. Filtration is intended to remove microorganisms (fungi and bacteria - not endotoxins), particulate matter such as fibres, drug precipitates and residues, glass splinters, metal and rubber, and air.[10]

c. Filters are considered a complement to intravenous therapy and not a substitute for aseptic technique.

d. Filtration during the infusion of intravenous solutions and medications is obtained through an integral filter or an add-on filter.

e. Filtration of a medication may be obtained during the aspiration of the drug from a vial or ampoule. A filter needle or an add-on filter between the needle and the syringe may be used.

f. Definitions

(i) Add-on filter (final inline) - a filter which can be added to any administration set by means of a luer fitting. An additional manipulation is required, thus providing greater potential for contamination, but may be less expensive to change should it become blocked.

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9. Turco, S.J., All about the Microporous Filter, National Intravenous Therapy Association, 0160-3930/78/1100/0217.
10. "I.V. Filters-0.2 micron", Health Devices, December 1979, page 27-49.

(ii) Integral filter - a filter which is built into a container to patient administration set. The number of manipulations may be reduced but it may be more expensive if the filter becomes blocked and the complete administration set must be changed.

(iii) Air lock - total obstruction of a hydrophilic membrane by air.

(iv) Air-venting filter - a filter which eliminates air from a liquid automatically by venting it to the outside through a hydrophobic membrane built into the filter housing.

(v) Hydrophilic membrane - a filter membrane which acts as an air barrier when wet but allows liquid to pass freely through.

(vi) Hydrophobic membrane - a filter which acts as a barrier to liquid but allows air to pass freely through.

8.2.2 Filter Pore Size

a. 0.5 to 1 micron filters retain particulate matter.

b. 0.45 micron filters retain particulate matter and some bacteria.

c. 0.22 micron filters remove all particulate matter, fungi and bacteria.

8.2.3 Advantages

The available evidence indicates that filtration will:

a. Reduce the complications from particulate matter.[11]

b. Reduce or eliminate infection from fungi and bacteria.[12]

c. Reduce the incidence of infusion phlebitis.[11,12]

d. Reduce or eliminate air emboli.[13]

11. Turco, S.J., All About the Microporous Filter, National Intravenous Therapy Association, 0160-3930/78/1100/0217.
12. Bivins, A.B., Rapp, R.P., Deluca, P.P., Harley, M., Griffen, W.O., "Final In-line Filtration-A Means of Decreasing the Incidence of Infusion Phlebitis", Surgery, April 1979, page 388-394.
13. Turco, S.J., All about the Microporous Filter, National Intravenous Therapy Association, 0160-3930/78/1100/0217.

8.2.4 Problems

a. Air locking causing total obstruction of a hydrophilic membrane.

b. Filter clogging may occur when debris accumulates on the filter surface, which will decrease the flow rate.

c. Drug binding to filter membranes may occur with some drugs.

d. The integrity of the hydrophobic filter can be affected by the presence of certain intravenous additives such as surfactants.

8.2.5 Selection

a. A filter should contain both a hydrophilic and a hydrophobic membrane with an automatic air vent.

b. It is desirable for a filter to permit gravity infusion of all common solutions. Blood products and fat emulsion cannot be administered through these filters.

c. The filter should be suitable for 24-hour use and permit flow rates of 200 mL per hour. A larger surface area permits a higher flow rate and decreases problems with blocked filters.

d. A filter should have minimal priming volume to reduce priming time and minimize waste of drugs and solutions.

e. The filter should be relatively inexpensive and convenient for clinical use.

f. Infusion pump filters should have a maximum pressure rating equal to or greater than the highest PSI (pounds per square inch) or mm/hg operating pressure of the infusion pump.[14] The filter should be air eliminating and package labels must indicate the maximum pressure rating.

14. "Infusion Pumps", Health Devices, March/April 1979, page 103-107.

8.2.6 Usage[15]

a. Microbe Retentive Filter

- TPN solution administration of aminoacid dextrose.
- Immune deficient or immune compromised patients (e.g. neonates, burn, leukemia and transplant patients).

b. Particulate Retentive Filter

- I.V.'s containing additives which are heavily particulated such as reconstituted antibiotics.
- All I.V. administration to critically ill patients.

8.3 Electromechanical Control Devices

8.3.1 General Considerations:

a. Because the manual flow clamps on gravity flow systems cannot provide the accuracy required for infusion of critical drugs and parenteral nutrition, electromechanical infusion control devices have become a popular and efficient means of controlling infusion rates. Generally, infusion devices are considered to be either controllers or pumps.

b.

b. An intravenous infusion pump is a device which, by exerting positive pressure on the fluid or I.V. tubing, automatically delivers intravenous fluids at a pre-selected flow rate and in most cases, to a pre-determined volume. Specific features include:[16]

- Generation of positive pressure.
- Usefulness where accuracy and positive pressure are necessary.
- More accuracy than controllers.

15. I.V. Filters - 0.2 micron Health Devices, December 1979, page 27-49.
16. Vanderveen, T.W., "Infusion Control Devices for Parenteral and Enteral Administration", American Journal of Intravenous Therapy, June-July 1978, page 16-30.

- May have multiple alarms.
- Usually require special administration sets.
- Used with solutions and drugs which require precise volume infusion.

c. The infusion rate regulator or infusion controller is a device which simply controls the infusion rate but relies on gravity fed infusion. Specific features include:[17]

- Control of rate of infusion of fluid by regulating gravity flow.
- No positive pressure other than the head pressure of the fluid itself.
- Rate is determined by counting of drops.
- Does have alarms.
- May or may not use standard administration sets.
- Used with solutions requiring some control but not precise hourly volume administration.

d. Constant monitoring, accurate flow rate, and improvement in I.V. therapy are but a few of the positive benefits associated with mechanical infusion devices.

e. Inservice training responsibilities must be considered. Aspects of equipment use such as quality assurance, maintenance and repair must be dealt with.

8.3.2 Problems

a. Many of the problems currently associated with the use of infusion control devices have to do with the fact that users do not understand the application and limitations of the equipment they are employing.

17. Vanderveen, T.W., "Infusion Control Devices for Parenteral and Enteral Administration", American Journal of Intravenous Therapy, June-July 1978, page 16-30.

8.3.3 Selection

a. Selection of infusion devices should involve:
   - Biomedical Engineers.
   - Nurses.
   - Pharmacists.
   - Physicians.

b. Points to consider:
   - Type of device.
   - Cost of device.
   - Cost of special tubing, if required.
   - Types of purchase agreements.
   - Accuracy and range of rate and volume.
   - Ease in handling, set up and operation.
   - Safety features including resistance to tampering, alarm functions, operating maximum pressure, keep vein open rate.
   - Available service and inservice education from the distributer.
   - Battery time to allow ambulation.
   - Ease of cleaning, ability to remain clean while operational.
   - Alarm system:
     (i) Audibility.
     (ii) Ability to incorporate into nurse call system.
     (iii) Inability to be turned off permanently by personnel.
     (iv) Prevalence of "nuisance" alarming.

8.3.4 Usage

a. If both pumps and controllers are used it is essential that these devices are being correctly matched with indications and applications.

b. Policies pertaining to the use of infusion control devices should be developed in order to prevent misuse and to minimize hazards and costs associated with their use. (see page 35, 8.3.6)

c. Specifically, the infusion of some solutions and drugs, as determined by hospital policy, warrants use of infusion control devices.

d. Pumps should be used primarily on patients with central lines or I.V. catheters and with caution on patients with scalpvein sets.

e. Clinical staff must determine which infusions require a pump, which can be regulated by a control device and which can be maintained by a standard administration set and manual flow clamp in order to prevent unnecessary cost.

f. The ideal infusion pump is:

- Capable of delivering and maintaining a constant infusion rate.
- Accurate and responds quickly to flow rate changes.
- Equipped with an infusion rate recorded in millilitres per hour.
- Adjustable from a very low to a high rate of infusion. This flow rate should not be affected by viscosity of fluid, patient movement, tubing characteristics or the height of the infusion solution container.
- Easy to clean.
- Equipped with a waterproof outer casing.
- Equipped with separate alarms for detecting end of infusion, air bubbles, an increase or decrease in flow rate, infiltration, occlusion, low battery power, broken or disconnected tubing, excessive pressure buildup within the system.
- Resistant to tampering by the patient or accidental setting changes.
- Equipped to switch automatically to battery power if line power fails or if the patient is transported or ambulatory.

- Capable of infusing clear and opaque fluids.
- Easy to use.
- Inexpensive.
- Fail safe or designed so that the patient is not harmed if a failure does occur.
- Portable (compact and lightweight).

8.3.5 Education and Training

a. Nursing staff must be accountable for utilizing infusion control devices safely and efficiently.

b. Continuous education programs for initial implementation and continuous training and re-training of personnel are imperative.

c. Operator manuals and instruction sheets, in English and French, provided by the manufacturer should be attached to the device for referral by those responsible for operating the pump in the clinical area.

Quality Assurance:

a. Regular performance evaluations should be carried out and recorded on each device.

b. Flow rate accuracy tests should be performed while the pump is operational, perhaps once or twice weekly, in order to provide an index of accuracy between performance tests.

8.3.6 Policy Establishment

a. An important aspect of the use of <u>any</u> type of equipment is to have policy that spells out exactly:[18]

(i) How the equipment is to be used.

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18. Vanderveen, T.W., "Infusion Control Devices for Parenteral and Enteral Administration", <u>American Journal of Intravenous Therapy</u>, June-July 1978, page 16-30.

(ii) Patient care areas in which it is utilized.
- applications
- indications.

(iii) What is to be done if there is a failure, etc.

(iv) The extent of inservice education programs.

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II REQUIREMENTS

A. PERSONNEL

1. Intravenous Therapy Personnel

1.1 Physician - must be currently registered in the province of employment and appointed to the hospital by the medical advisory board of the institution, or equivalent body.

1.2 Nurse - must be currently registered in the province of employment.

1.3 I.V. Nurse - must be a registered nurse specially trained and authorized by the hospital to perform special procedures specific to intravenous therapy and be currently registered in the province of employment.

1.4 Pharmacist - must be currently registered in the province of employment.

1.5 Pharmacy Technician - should be trained in a structured educational program which imparts the knowledge and skills essential for the preparation of I.V. admixtures and TPN.

2. Knowledge and Competencies Required of Personnel

2.1 Physician

It is required that the physican:

a. Be familiar with the hospital's policies and procedures on intravenous therapy.

b. Be knowledgeable regarding the pharmacology, indications, adverse effects, dosage, precautions, and administration of parenteral medications.

c. Be knowledgeable of the indications for I.V. therapy, its hazards, and complications (i.e. microbiological, technical, metabolic).

d. Be aware of the actual and/or potential incompatibilities as well as the stability of intravenous medications.

e. Be knowledgeable of available resource material and drug information on all aspects of I.V. therapy.

f. Be knowledgeable of certain required technical tasks for the preparation and administration of I.V. medications.

g. Be knowledgeable about various I.V. delivery systems and related equipment, in the hospital.

h. Be knowledgeable of I.V. terminology and prescribing procedures.

i. Be knowledgeable of various I.V. infusion fluids and their appropriate use.

j. Be knowledgeable of the various laboratory tests and their clinical significance to the I.V. therapy of the patient.

k. Be knowledgeable of blood and blood components.

l. Be knowledgeable of the immediate treatment and investigation of complications arising from I.V. therapy.

2.2 Nurse

It is required that the nurse:

a. Be familiar with the hospital's policies and procedures on intravenous therapy.

b. Understand the actions, side effects, methods of administration, and proper storage of the medications.

c. Be aware of the possibility of actual and/or potential incompatibilities of intravenous admixtures.

d. Demonstrate on a regular basis, the ability to perform the required technical tasks.

e. Demonstrate a knowledge of the principles and practices of aseptic technique.

f. Must know the basic anatomy and physiology of the circulatory system.

g. Must have a basic knowledge of blood and blood components.

h. Have the right and the responsibility to refuse to administer a drug that:

- Is in apparant excess.
- Has a possible side effect that may require medical intervention.

- The nurse's training or knowledge of the drug is inadequate for the situation.[19]

2.3 I.V. Nurse

It is required that the I.V. nurse, in addition

a. Has in depth knowledge in:
   - Written hospital policies and procedures of I.V. therapy.
   - Policies of I.V. drug administration and selection of drugs on the hospital approved list.
   - Incompatabilities, actions, side effects, method of administration and storage of drugs.
   - Anatomy and physiology in the systems of circulation and coagulation.
   - Fluid and electrolyte replacement.
   - Aseptic technique, equipment and care of the I.V. system.
   - Legal implications of procedures and administration of I.V. products.
   - All delegated functions approved by the hospitals.

b. Be competent in the art of venipuncture and all delegated skills.

c. Maintains expertise by the practise of these skills on a regular basis.

d. Obtains authorization by the teacher and a delegated physician annually.

2.4 Pharmacist

It is required that the Pharmacist:

a. Be familiar with the hospital's policies and procedures on intravenous therapy.

19. Vancouver General Hospital Parenteral Drug Therapy Manual, June 1980, page 4.

b. Be familiar with the policies and procedures for the preparation, compounding, distribution and storage of intravenous medication as established by the pharmacy department.

c. Be knowledgeable regarding the pharmacology, indication, adverse effects, dosage, administration, and proper storage of medication.

d. Be knowledgeable regarding the actual and/or potential incompatibilities as well as the stability of intravenous medications.

e. Be knowledgeable about various I.V. delivery systems.

f. Must know the basic anatomy and physiology of the circulatory system.

g. Must have a basic knowledge of blood and blood components.

2.5 Pharmacy Technician

It is required that the Pharmacy Technician:

a. Be familiar with and review on a regular basis the policies and procedures of the pharmacy department on I.V. medications and I.V. admixtures.

b. Have formal training on various aspects of I.V. therapy from a recognized school or hospital. Training should include a basic knowledge in the following areas:

- Orientation of intravenous admixture program.
- Nature of drugs and their use.
- Pharmaceutical and medical terminology abbreviations and symbols.
- Parenteral administration of medications.
- Solutions and types of I.V. systems.
- Pharmaceutical calculations.
- Incompatibilities.
- Equipment used in the manufacutre and packaging of I.V. medications.
- Record keeping.
- Unit dose packaging.
- Aseptic technique and compounding of parenterals.

c. The above training must be conducted under supervision of a pharmacist.

3. Responsibilities and Duties of Personnel

3.1 Physician

a. To assess the patient's clinical needs for I.V. therapy.

b. To prescribe the appropriate I.V. therapy using the approved physician's order form of the institution, with accuracy and completeness. Specific orders should include name of medication (generic terminology), dosage, infusion fluid, volume, rate of and frequency of administration, and the time at which the order is written.

c. To initiate I.V. therapy where the need arises.

d. To prescribe the necessary laboratory tests and special procedures required to evaluate the clinical state of the patient prior to and during I.V. therapy.

e. To review and evaluate the patient's condition, all laboratory test results, nursing notes and consultant's reports that may affect the I.V. therapy of the patient.

f. To instruct auxiliary personnel of any special procedures to be performed with the I.V. therapy of the patient.

g. To accept ultimate responsibility for evaluating the clinical progress of the patient and making the necessary changes in therapy.

h. To communicate decisions affecting the I.V. therapy of the patient with other members of the health care team.

i. To be able to perform the necessary technical tasks required for insertion of I.V. cannulas and I.V. catheters and the preparation and administration of I.V. admixture.

j. To be responsible for keeping abreast of current trends in I.V. therapy.

k. To participate in the development and implementation of written policies and procedures to ensure the quality of I.V. therapy.

3.2 Nurse

a. To perform technical tasks of the job consistent with scientific principles and hospital policies.

b. To be responsible for keeping abreast with current technology relative to I.V. administration by attending a minimum of one continuing education conference, meeting or seminar annually.

c. To be accountable to the patient and family for the education, the physical and psychological care provided and to the nursing administration for the totality of work performance.

3.3 I.V. Nurse

a. To be assigned specifically to I.V. therapy.

b. To be highly competent in the art of venipuncture and all other delegated functions.

c. To demonstrate knowledge and skill on a daily basis to maintain expertise.

d. To establish a protocol to ensure consistency in quality of care and infection control.

e. To standardize procedures, aseptic technique and equipment related to I.V. therapy.

f. To review and update I.V. policies and procedures on a regular basis.

g. To evaluate and implement new equipment.

h. To be represented on hospital committees, i.e., I.V., administration, pharmacy and infection control.

i. To refuse to perform any procedure not approved and delegated by the hospital.

j. To assist in policy implementation through regular inservice to staff nurses and new members.

k. To regularly attend programs to update knowledge.

l. To participate in patient teaching.

m. To initiate, develop and participate in studies and statistics in I.V. therapy and to publish findings.

3.4 Pharmacist

a. To communicate his knowledge to those who prepare and/or administer I.V. admixtures.

b. To maintain resource material which provides current information pertaining to all aspects of I.V. admixtures.

c. To develop, periodically evaluate and implement written policies and procedures affecting the quality of I.V. admixtures.

d. To ensure proper storage of all materials used in compounding I.V. admixtures.

e. To educate and train all personnel involved with the preparation of I.V. admixtures, particularly with respect to compounding procedures, aseptic technique and pharmaceutical calculations.

f. To review the prescriber's written I.V. order (the original order or a carbon copy) for interpreting and evaluating this order in terms of its therapeutic and pharmaceutical appropriateness.

g. To coordinate and supervise the compounding of I.V. admixtures.

h. To inspect the work sheet, empty drug packages and the finished, labelled admixture before the product is dispensed, signing the work sheet to indicate completion of the inspection.

i. To distribute and properly store all I.V. admixtures.

3.5 Pharmacy Technician

a. The intravenous admixture technician shall be trained to perform the following duties in harmony with policies and procedures of the pharmacy department under the supervision of a pharmacist:

- To prepare and complete uniform labels.
- To assemble drugs and solutions to be used for each admixture.
- To reconstitute additives.
- To prepare the admixture.
- To check the admixture for presence of particulate matter.

- To label the admixture.
- To initiate appropriate records.
- To restock supplies in the admixture area.
- To maintain the clean air centre in a neat and orderly manner.

B. FACILITIES

1. Space

1.1 Space and facility requirements will vary depending upon the scope of services provided and should be planned according to generally recommended practices as found in the literature.[20]

1.2 A clean work area with adequate lighting, good clean air ventilation, separated from heavy traffic and from contaminated storage areas, should be available for the safe compounding of admixtures.

1.3 Sufficient counter top working area and convenient hand washing facilities must be available.

1.4 Space for storage of current material must be readily available.

2. Storage

2.1 A convenient storage area should be available for the storage of materials used for the preparation of I.V. admixtures.

2.2 The storage area should be temperature controlled to prevent product decomposition and properly lighted for ease of label reading.

2.3 There should be a separate designated storage area for stock solutions and a separate refrigerated storage area for prepackaged I.V. medications and I.V. admixtures.

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20. Health and Welfare Canada, Evaluation and Space Programming Methodology for the Pharmacy, Ottawa, 1979, 91 pages.

C. EQUIPMENT

1. Equipment needs will vary from institution to institution and these will be determined by space available, expected workload and types of products to be prepared and administered. (see page 12, C.2.)

2. Pharmacy equipment should include but not be limited to:
   a. Laminar Air Flow Hood (Class-100) (sufficient number).
   b. Bio-hazard Hood (Class 2, type A)(for handling of cytotoxic drugs).
   c. Refrigerator.
   d. Delivery carts.
   e. Mechanical agitator.
   f. A lighted device designed for visual inspection of I.V. admixtures for particulate matter.
   g. pH meter.
   h. Membrane filtration systems.
   i. Microscope.
   j. Typewriter.
   k. Storage carts or shelves.
   l. Vacuum pump.
   m. Waste baskets.

3. Administration of I.V. medications and I.V. admixtures will require various administration apparatus systems, including infusion devices and administration sets.

III THE ADMINISTRATION OF BLOOD AND BLOOD COMPONENTS

A. GENERAL CONSIDERATIONS

1. The policies and procedures concerning patient safety during the administration of intravenous fluids and admixtures apply equally to the administration of blood and blood components. Procedures for identification of the patient must be enforced since it has been reported that the greatest number of preventable fatalities from blood transfusion are due to "clerical errors" such as drawing the blood specimen for cross-match from the wrong patient or administration of the wrong unit of blood to the patient.[21]

2. Canadian hospitals are supplied with blood, components and plasma fractions by the Canadian Red Cross Society Blood Transfusion Service and include the following:

   2.1 Whole Blood supplied as 450 mL of blood with 63 mL of anticoagulant.

   2.2 Red Cell Concentrates which are prepared by removing approximately 200 mL of plasma from whole blood. The haematocrit is about 30% higher than that of whole blood. This may lead to a decreased flow rate due to the increased viscosity.

   2.3 Frozen Red Cells contain approximately 85-90% of the red cell mass of a unit of whole blood. Reconstituted frozen cells should not be stored longer than 24 hours because of the possibility of bacterial contamination.

   2.4 Leukocyte Poor Red Cell Preparations are standard red blood cell preparations from which most white cells are removed by a variety of methods. If the bag must be entered during the process, there is a potential of contamination and the unit should be administered immediately.

   2.5 Fresh Frozen Plasma contains plasma of 1 unit in an unconcentrated form. It should be administered promptly after thawing to prevent deterioration of factors V and VIII.

21. Myhre, B.A. "Fatalities from Blood Transfusion," Journal of the American Medical Association, Sept. 19, 1980, pages 1333-1335.

2.6 Stored Plasma contains reduced levels of labile clotting factors but is effective in patients requiring volume or protein replacement.

2.7 Platelet Concentrates contain 6×10^{10} platelets on average in a volume of 50 mL of plasma and are acceptable for use up to 72 hours after the collection of the unit of blood from which they were extracted. Platelets should therefore be administered promptly after delivery from the transfusion centre.

2.8 Cryoprecipitated Factor VIII is prepared from a single donation of fresh blood. It should be administered promptly after thawing for maximum effect.

2.9 Factor VIII Concentrate is obtained from pooled fresh frozen plasma. The lyophilized material is reconstituted with sterile diluent and must be filtered before administration.

2.10 Leukocyte Concentrate is prepared by pheresis from a single donor. The granulocyte preparations consist of 400 mL of plasma containing 1.5×10^{10} granulocytes and should be issued promptly.

2.11 Factor IX Complex is a lyophilized preparation obtained from pooled plasma. It is reconstituted with sterile diluent and filtered before administration. Rapid infusion may cause irritation at the site of injection.

2.12 Normal Serum Albumin is prepared from normal human plasma and is available in concentrates of 5% and 25%. It must be administered through an administration set with an integral airway. Filters are required for some products and the package insert should be consulted.

For more detailed information, and a discussion of the clinical indications for specific preparation use, please refer to Clinical Guide to Transfusion, The Canadian Red Cross Society, 1980.

B. ADMINISTRATION

1. All blood and blood products for intravenous infusion should be given through a standard blood set filter. (170 microns). An 80 micron filter blood administration set is now available. Special microag-

gregate filters of 40-20 microns should be used in massive rapid infusion. These filters may be used with infusion control devices.

2. The administration set should be changed after the administration of four units of blood, and at least every 24 hours as well as before restarting I.V. fluids.

3. The line must be filled before the infusion of blood with a compatible solution such as isotonic saline. Ringer's lactate and glucose are not compatible solutions. Intravenous medication or solution must not be added directly to blood or any blood product.

4. A unit of blood can be infused in 1 1/2 to 2 hours and should not take longer than four hours because of the possibility of bacterial proliferation and red cell hemolysis at room temperature.

5. Whole blood or red blood cell concentrates should be administered through a cannula, 19 gauge or larger.

6. Specific procedures to prevent errors in administration of blood and blood products, including patient identification, should be vigorously enforced.

7. The patient must be observed frequently to detect signs of such transfusion reactions as hemolytic, allergic, pyrogenic and hyperthermic reactions and reaction to contaminated blood. Hemolysis and hepatitis can occur as delayed transfusion reactions.

8. The use of a blood pump in emergency situations should be in accord with hospital policy.

IV TOTAL PARENTERAL NUTRITION (TPN)

A. GENERAL CONSIDERATIONS

1. TPN is the intravenous infusion of amino acids, dextrose, fat, vitamins and minerals through a central or peripheral vein. The use of TPN is indicated when the nutritional status of the patient cannot be maintained through oral or by enteral feedings.

2. Total Parenteral Nutrition is a multidisciplinary specialty service that requires the direction of an interdisciplinary committee composed of various team members, from medicine, surgery, nursing, pharmacy, dietetics, social services and clinical laboratories. These members should be responsible for creating and enforcing TPN policies and procedures, providing consultation, supervising treatment, constant monitoring of the patient, and setting criteria for admission of patients to this program.

3. In general, the preparation of TPN solutions should be the responsibility of the pharmacy department. All solution compounding and ingredient admixing should be done only in the pharmacy. However, there may be certain instances where the addition of some ingredients such as vitamins, trace minerals, drugs etc. may be added in the nursing unit.

4. Pharmaceutical requirements for facilities, equipment and personnel will vary and will depend on the type of service offered and the type of method used to prepare the TPN solutions.

5. There are basically two methods at present used by pharmacists to compound TPN solutions:
   - The "bottle" method for individual patient needs.
   - The "bulk" method for large scale production of standardized solutions.

5.1 The "bottle" method is the most popular and widely used, particularly with hospitals having I.V. admixture services. Basically, this method involves aseptic admixing of commerical sterile stock solutions in a sterile and pyrogen free glass or plastic container, using sterile transfer tubing under Laminar Air Flow Hood (LAFH) conditions.

5.2 The "bulk" method is a more specialized procedure used mainly by certain teaching hospitals with large TPN programs and appropriate facilities. Basically, this method involves the aseptic admixing of commercial sterile stock solutions in a large depyrogenized stainless steel or glass mixing vessel. The final admixture is sterilized by membrane filtration under LAFH conditions and packaged into sterile and pyrogen free glass or plastic containers.

5.3 Facilities, equipment and personnel needs between the two methods of TPN solution compounding will differ.

B. FACILITIES

1. Space

1.1 Adequate facilities and space should be available for the cleaning and storage of equipment used for the preparation and packaging of solutions.

1.2 The floor should be constructed of smooth concrete material and must be cleaned daily with a detergent disinfectant.

1.3 The walls and the ceiling should be constructed of solid smooth nonporous material for ease of cleaning and maintenance.

1.4 No cartons or unnecessary paper boxes should be stored in the compounding or sterile filling areas. These become dust collectors and carriers of contaminants.

1.5 The facilities for aseptic compounding and sterile filling should be physically separated from areas of typing, labelling, packaging, storage and record filing.

2. Storage

2.1 Light sensitive solutions must be stored in the manufacturer's protective packaging.

2.2 See section II. D. 2.

C. EQUIPMENT

1. A suitable mixing vessel, either stainless steel or glass, and a membrane filtration system should be available for the bulk compounding, sterilization, and packaging of TPN solutions.

2. Sterilization equipment (e.g., autoclave) should be available for decontamination of equipment, and a hot water bath/incubator should be available for performing the invitro limulus pyrogen test.

3. Medical grade polyvinyl chloride or silicon tubing and containers should be available for the admixing and packaging of ingredients.

4. Equipment used for the bulk compounding and sterile filtration of solutions must be rendered free of pyrogenic substances by thorough washing with a solution of a strong alkali detergent (e.g. 5% trisodium phosphate) and rinsed with pyrogen free water.

5. See section II. E.

D. PERSONNEL

1. See section II. A.

2. Other Supporting Departments and Services

- Biochemistry
- Biomedical Engineering
- Dietetics
- Hematology

- Microbiology
- Psychiatry
- Radiology
- Rehabilitation
- Social Services

E. KNOWLEDGE AND COMPETENCIES REQUIRED OF PERSONNEL

1. Physician
   - 1.1 It is required that the physician have formalized training in clinical nutrition.
   - 1.2 See section II. B. for knowledge and competencies required of other personnel.

F. RESPONSIBILITIES AND DUTIES OF PERSONNEL

1. Physician
   - 1.1 To recognize malnutrition and promptly apply enteral or parenteral support.
   - 1.2 To recognize indications and contraindications to these support methods.
   - 1.3 To participate in a multidisciplinary institutional support committee appointed by and be responsible to the medical advisory board of the hospital.
   - 1.4 To provide nutritional consultation.
   - 1.5 To perform nutritional assessments.
   - 1.6 To place the central venous catheter.
   - 1.7 To provide inservice teaching to other team members.
   - 1.8 To select appropriate TPN solution to meet the patient's nutritional requirements.
   - 1.9 To monitor patients.
   - 1.10 See section II. C.

2. Nurse
   2.1 To possess adequate knowledge of all aspects of TPN therapy.
   2.2 To carry out patient education.
   2.3 To assist the physician with catheter insertion.
   2.4 To monitor patients for signs and symptoms of potential complications.
   2.5 To perform catheter care according to established protocol.
   2.6 To supervise the preparation of solutions when specifically assigned this role.
   2.7 See section II. C.

3. Pharmacist
   3.1 To monitor patients and recommend solution changes.
   3.2 See section II. C.

4. Pharmacy Technician
   4.1 See section II. C.

G. RECORDS

1. Records must be established and maintained for the manufacture, quality control and administration of all TPN solutions. These records must be easily accessible for review.

H. ORDER FORM

1. A specially designed order form should be established and approved by the institution for the prescribing of all TPN orders. The order form should include such information as:
   - Patient addressograph.
   - Diagnosis.
   - Reasons for putting patient on TPN.
   - Date order written and date TPN to be started.
   - Basic solutions and additives.

- 24 hours total fluid and nutrient intake.
- Protocol prior and during TPN.
- Signatures of prescriber and pharmacist.
- Precautions and other pertinent information that will assist the prescriber.

I. PREPARATION OF TPN SOLUTIONS IN THE PHARMACY

1. Receiving and Storage
   - 1.1 Receiving and Handling of Raw Materials
     - 1.1.1 See section I. B. 1.1.
   - 1.2 Handling of Defective Raw Materials
     - 2.1.1 See section I. B. 1.2.
   - 1.3 Storage of Raw Materials
     - 3.1.1 See section I. B. 1.3.

2. Compounding
   - 2.1 Physician's Order
     - 2.1.1 All TPN orders must be prescribed by a qualified physician using the appropriate TPN order form of the institution. In general, TPN is not an emergency, therefore TPN should not be started prior to pharmacy receiving and screening order.
   - 2.2 Screening and Interpreting of Order
     - 2.2.1 The pharmacist must assume responsibility to carefully screen and interpret all TPN orders for formulation problems, incompatibilities, calculation accuracy, completeness and appropriateness. Any order discrepancies related to the above must be clarified with the prescribing physician.
     - 2.2.2 Any changes in TPN orders must be made on a TPN order form and a copy sent to pharmacy.
   - 2.3 Preparation of Worksheet/Master Formula
     See section I. B. 2.4.

2.4 Proper Use of the Laminar Air Flow Hood

See section I. B. 2.5.

2.5 Compounding Technique

See section I. B. 2.7.

2.6 Labelling

See section I. B. 2.8.

2.7 Records

See section I. B. 2.9.

2.8 Storage

2.8.1 All TPN solutions must be stored at 4° to 8°C until use or expiration date.

2.8.2 A separate refrigerator is required for TPN solutions and should be routinely cleaned.

2.8.3 See section I. B. 2.10.

2.9 Quality Control

See section I. B. 3.

J. TRANSPORTATION AND STORAGE IN PATIENT CARE AREA

See section I. C. 1.

K. METHODS OF ADMINISTRATION

1. Central Venous Route

1.1 An indwelling central venous catheter permits prolonged administration of nutrient solutions directly into a region of high blood flow where rapid dilution occurs, therefore minimizing the occurrence of phlebitis and thrombosis. Central venous catheter insertion must be considered an important surgical procedure. All measures to prevent sepsis must be observed. (e.g., mask, gown, gloves).

1.2 Following insertion of the catheter, X-ray confirmation of position must be obtained prior to infusion of any TPN solution to ensure that the tip lies in the superior vena cava.

1.3 Following correct catheter placement and confirmation, infu sion of the concentrated nutrient solution can begin. In th meantime, the line is kept open with infusion of an isotoni crystalloid solution.

2. Peripheral Route

2.1 The peripheral route for administering TPN solutions may b indicated if short term therapy is anticipated.

2.2 The technique of peripheral infusion is similar to conventiona methods. The site of infusion should be changed ideally ever 24 to 48 hours.[22, 24]

2.3 The administration set should be changed at least every 2 hours[23] at the time that a new container of solution i established.

2.4 Infusion rates as well as visual inspection of the infusion sit should be monitored on an hourly basis.

3. Administration Sets

3.1 Changing of administration sets must involve strict asepti technique and patient safety precautions.

3.2 Administration sets should be changed at the time of containe change.

3.3 Fat emulsion administration sets should be changed every 24 t 48 hours during continuous infusion and changed or remove following each intermittent container infused.

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22. Freeman, J.B., "Peripheral Parenteral Nutrition", Canadian Journal o Surgery, November 1978, page 489-492.

23. Goldman, D.S., Maki, D.G., "Infection Control in Total Parenteral Nutrition", Journal of the American Medical Association, March 1973, pag 1360-1364.

24. Ota, D.M. et al, "Total Parenteral Nutrition", Surgery, May 1978, page 503 520.

L. PATIENT MONITORING

1. Prior to starting TPN, and regularly during therapy, the patient's nutritional requirements must be assessed in accordance with hospital protocol.

M. CENTRAL CATHETER AND SITE CARE

1. Catheters inserted for parenteral nutrition should be used exclusively for that purpose. Routine blood withdrawal, infusion of blood products, medications, other I.V. solutions and central venous pressure determinations are contraindicated due to the high risk of sepsis. Stopcocks should never be added to the infusion system.

2. Adherence to strict aseptic technique is imperative to prevent infection. The following care is suggested when the dressing is changed:
   - 2.1 The nurse, patient and anyone present during the dressing change should be masked to prevent contamination of the catheter site by nasal bacteria.
   - 2.2 The nurse should perform a surgical scrub (including cleaning under the nails) before assembling the dressing tray.
   - 2.3 The dressing tray and necessary equipment should be assembled in a clean, quiet area.
   - 2.4 After removal of the old dressing, the nurse's hands must be washed.
   - 2.5 A swab from the catheter site should be sent for bacterial and fungal culture and sensitivity. This is to assess the effectiveness of the antiseptic used and the occlusiveness of the dressing.
   - 2.6 The skin and exposed catheter should be thoroughly cleansed, by an iodophor scrub.
   - 2.7 An antiseptic/antibiotic ointment may be applied to the catheter site.

2.8 The dressing material selected must be waterproof, occlusive and comfortable. This may include:

a) An hypoallergenic, transparent, adhesive, waterproof, plastic dressing.

b) Gauze covered by a hypoallergenic, waterproof tape.

2.9 The dressing should be changed routinely or whenever it is non-occlusive.

N. COMPLICATIONS OF TOTAL PARENTERAL NUTRITION THERAPY

1. Complications may be divided into three categories:
   - Technical
   - Septic
   - Metabolic

2. Potential complications are many. However, with adequate patient monitoring and strict adherence to aseptic technique, many of these complications can be prevented.

3. A nutrition protocol, containing specific procedures and policies outlining specific monitoring parameters, should be followed.

4. Technical Complications

4.1 Central venous catheter related complications that can be due to insertion and care and improper infusion practices include:

- Air Embolism
- Catheter Embolism
- Hemothorax
- Pneumothorax
- Subclavian Arterial Puncture
- Subclavian Vein Thrombosis
- Superior Vena Cava Thrombosis

5. Septic Complications

5.1 Catheter related sepsis can be defined as positive blood cultures along with microbial growth from the cultured catheter tip.

6. Metabolic Complications

6.1 The most common metabolic complication is related to glucose tolerance. Hyperglycemia occurs when the rate at which the body can metabolize glucose is exceeded.

6.2 An extreme complication of hyperglycemia is hyperosmotic, nonketotic hyperglycemia dehydration and coma.

6.3 Electolyte Imbalance.

6.4 Fatty Acid Deficiency is a rare complication and can be eliminated by providing linoleic acid in the form of fat emulsion.

6.5 Vitamin Deficiency

Vitamin supplementation should be an integral part of the TPN regimen. Water soluble and fat soluble vitamins should be added to the solutions.

6.6 Vitamin Toxicity

Fat soluble vitamins should be closely monitored to prevent vitamin toxicity.

6.7 Trace Element Deficiency

Zinc, copper and chromium deficiency may occur when no trace elements are added to the solution. The most common is zinc deficiency, seen fairly quickly after the initiation of TPN, particularly in malnourished patients.

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APPENDICES

APPENDIX I

SUGGESTED FUTURE RESEARCH

The rapid advancement of intravenous therapy, including such specialties as parenteral nutrition, necessitates the need for continuous research towards improving the efficacy of this therapy.

Areas which have been, and continue to be, the focal points for research are:

- Administration systems
- Catheter dressings
- Centralized versus decentralized I.V. programs
- Freezing of admixtures
- Infection control
- I.V. filters
- I.V. teams
- Solutions
- Stability and compatibility

A great deal of literature has been generated from the United States regarding the above areas of concern. There is, however, limited documentation in Canadian literature. It is imperative that hospitals, industry and the government work together to answer the various questions and make the required information available to practitioners. The following are areas where such effort can be directed:

1. Research to develop appropriate and practical ways to train and educate personnel involved or specializing in I.V. therapy.
2. Research to evaluate and assess the clinical significance of I.V. teams with regard to better patient care and cost effectiveness.
3. Continued research for the development of a good and practical quality control system, to assure the ultimate quality in the preparation and administration of all I.V. solutions and admixtures.

4. Continued work to develop higher standards of practice for the most effective way of compounding I.V. admixtures, including parenteral nutrition solutions.

5. Continued research to develop and evaluate various I.V. solutions including specialty products such as amino acids, fat emulsions, vitamins and trace elements, for efficacy, risks and benefits to the patient.

6. Continued research into the area of product stability and compatibility of I.V. admixture components, including the freezing of I.V. admixtures, and the development, as well as provision, of updated information for the practitioners.

7. Continued studies to examine and evaluate the effect of multi-additive additions in various I.V. infusion fluids on particulate matter generation and the clinical significance of particulate matter in I.V. solutions.

8. Continued research and clinical studies for the design, development and evaluation of better solution delivery systems. Such research should consider administration sets, catheters, and infusion control devices.

9. Continued studies to evaluate the benefits, risks, and cost of filters with clear identification of situations where filters should or should not be used. Furthermore, research should focus on developing the optimal type of filter, with recommendations on its structural design including type of material to be used for its construction.

10. Continued research and clinical studies to design, develop, evaluate and standardize catheter dressing procedures for both peripheral and central I.V. therapy.

11. Control studies to develop practical, efficient and reliable systems for monitoring, preventing and reporting infection related to the preparation and administration of I.V. solutions.

12. Studies to confirm and establish clearly defined times for changes of administration sets, including I.V. filters and infusion fluid containers.

13. Continued research to evaluate and improve packaging and packaging components for I.V. solutions. In addition, research should be directed toward the compatability of ingredients with containers (e.g. medication absorption/adsorption, leaching of container materials) and their clinical significance.

14. Research to evaluate centralized versus decentralized I.V. admixture services in terms of efficiency and cost effectiveness.

APPENDIX II

GLOSSARY

For the purposes of this document, the following definitions have been adopted.

1. **Additive** - A medication or electrotyte added to a parenteral dosage.

2. **Administration Set**- A sterile disposable device used to administer fluids intravenously. It is composed of:

   i) A plastic spike to be inserted into the entry port of the I.V. container.
   ii) A drip chamber to make the flow rate visible.
   iii) A length of plastic tubing connecting the drip chamber to a latex injection sleeve.
   iv) A rigid plastic device which extends from the sleeve and accepts a needle or catheter.
   v) Adjustment clamp on the tubing to regulate the flow, and
   vi) A Y injection site.

3. **Admixture** - A combination of two or more substances given parenterally when administered together in a single unit.

4. **Ampoule** - A small glass container with a narrow neck constriction which has been heat sealed so as to preserve its contents in a sterile condition.

5. **Aseptic Technique** - The use of procedures in the preparation and administration of parenteral products which minimize or prevent the introduction of microorganisms.

6. **Cannula** - A generic term which includes all types of steel needles and plastic catheters used for access to the vascular system.

7. **Catheter** - A device for maintaining entry into the vascular system. It is composed of two elements: a hub which locks on the tip of the barrel of the syringe or administration set and a cannula, a hollow tube which is made from polyvinyl chloride, teflon, polyethylene, or silicone. Commonly, a trochar is used in cannulation of the vein.

8. **Central Venous Pressure (CVP)** - Denotes the pressure of the venous blood in the right atrium. It is used to assess the relative pressure in the right atrium and the ability of the right heart to tolerate an increase in volume.

9. **Compatibility** - The admixing of two or more drugs without undesirable physical and/or chemical changes resulting.

10. **Container** - A device composed of glass or plastic which is used for the storage and delivery of parenteral fluids.

11. **Contaminant** - The presence of bacteria, pyrogens or any other organic, inorganic and particulate matter in parenteral products.

12. **Continuous Intravenous Infusion** - The administration of a prescribed volume of solution over an ordered period of time and/or at a specified rate of administration.

13. **Controllers** - Devices intended to minimize errors in flow rates by counting drops electrically or extruding volumes of fluid mechanically and/or electronically.

14. **Direct I.V. Push or Bolus** - The administration of the required dose of the medication by means of a syringe, directly into a vein or through a designated injection site closest to the infusion needle in the tubing of the administration set.

15. **Drip Chamber** - A component of an intravenous administration set which collects the solution as it leaves the intravenous container. The infusion rate can be ascertained by counting the rate that drops enter the chamber.

16. **Emulsion** - A system consisting of two immiscible liquids, usually water and oil, dispersed as small droplets giving the appearance of an opaque homogenous liquid.

17. **Flushing the Line** - The introduction of a small volume of fluid into an intravenous administration set to remove any residual material from the primary large volume parenteral (LVP) and thereby minimizing or preventing an incompatiblity between the drug to be administered and the solution in the primary line.

    This term is also used to describe the process of purging the administration set of air prior to attaching the administration set to the I.V. site when a therapy is initiated or the administration set is replaced.

18. **Heparin Lock** - A closed cannula system with a resealable injection site that is kept patent between use by flushing and filling with heparin or heparinized saline.

19. **Incompatibility** - The result when one medication is mixed with others producing a product that is therapeutically, chemically or physically unsuitable for administration.

20. **Infiltration** - The diffusion or accumulation of foreign substances in extravascular tissue resulting in edema and/or necrosis of cells. (commonly referred to as interstitial)

21. **Infusion Fluids** - Parenteral solutions intended to be administered intravascularly.

22. **Infusion Pump** - A mechanical electrical device which infuses fluid by positive pressure. It controls the flow rate with more precision than traditional gravity-flow and clamp systems.

23. **Injection** - A method whereby the skin is penetrated and parenteral fluids are introduced into body tissues, cavities or the vascular system.

24. **Instability** - Changes in the physical, chemical or therapeutic characteristics of an intravenous admixture which result in a loss of ten per cent or more of its labelled potency claim, and which renders the product unsuitable for administration.

25. **Intravenous Hyperalimentation (IVH)** - The intravenous administration of amino acids, hypertonic dextrose, vitamins and minerals as the basis of parenteral nutrition.

26. **Intravenous Team (I.V. Team)** - Specially trained registered nurses responsible for all aspects of intravenous therapy which may include the following: preparation and administration of drugs and solutions, administration of blood and components, initiation of therapy.

27. **Intermittent Infusion** - The administration of a required dose of medication or intravenous fluid at a prescribed rate over a specified time interval.

28. **Large Volume Parenterals (LVP)** - Injections intended for intravenous use which are packaged in single dose units in glass or plastic containers holding 100 mL or more of fluid. They are sterile, pyrogen free, and free of visible particulate matter.

29. **Macro drip set** - Standard parenteral solution administration set delivering between 10 and 20 drops per mL depending on the manufacturer.

30. **Micro drip (mini drip) set** - Parenteral solution administration sets delivering 60 drops of fluid per mililitre. They are used when controlled volume is essential, i.e. fluid restriction or administration of potent medications.

31. **Needle** - A metal device for entering the vascular system consisting of a hollow tube enlarged at one end to form a hub which attaches to a syringe or administration set and a pointed, hollow shaft composed of stainless steel.

32. **Piggy Back** - The administration of a second solution intermittently or by continuous infusion through a Y tube or Y injection site attached to the primary administration set.

33. **Reconstituted Product** - The result of adding a suitable diluent in the proper volume to sterile solids or lyophilized powders.

34. **Solution** - A system consisting of solids or liquids completely dissolved in a liquid system, usually water.

35. **Small Volume Parenterals (SVP)** - These are sterile solutions intended for intravenous use which are packaged either in a single dose or multi-dose glass or plastic container holding less than 100 mL of fluid. They are sterile, pyrogen-free and free of visible particulate matter.

36. **Stability** - The degree to which a product retains the physical, chemical, and therapeutic properties that it possessed at the time of manufacture.

37. **Thrombophlebitis** - Inflammation of a vein associated with thrombus formation.

38. **Thrombosis** - Formation, development or presence of a thrombus.

39. **To keep Vein Open (TKVO or KVO)** - Keep I.V. fluid running at a minimum rate in anticipation of therapy. With gravity fed systems, the rates should exceed 10 mL/hour to prevent the entrance of blood into the needle and tubing.

40. **Total Parenteral Nutrition (TPN)** - The intravenous administration of amino acids, dextrose, fat, vitamins and minerals through a central or peripheral vein.

41. **Underfill or Partialfill Containers** - Commercially supplied mini-type infusion containers of 50-100 mL sterile infusion fluid used for the prescribed dilution and administration of medications.

42. **Vial - multiple dose** - A rubber stoppered container intended for multiple dose use. This vial contains a preservative and is sealed in such a manner that when opened the metal seal and rubber stopper remains intact.

43. **Vial - single dose** - A small rubber stoppered container intended for single dose use. This vial does not contain a preservative and is sealed in such a manner that when opened the metal seal and rubber stopper are automatically removed, indicating that the content is no longer intact and sterile and must be discarded if not used immediately.

44. **Volume Control Sets** - Calibrated plastic fluid chambers used as measuring devices in conjunction with an established I.V. system. A dose of medication may be added directly through the injection site into the calibrated chamber that contains a predetermined amount of the primary infusion fluid (usually 50-150 mL). This volume may be administered at varying rates.